

NEW UPPER CARBONIFEROUS CHELICERATA (ARTHROPODA) FROM SOMERSET, ENGLAND

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ABSTRACT. Well preserved arthropods from the Farrington Group (Westphalian D) of the Somerset coalfield are described. Ten specimens of *Euproops kilmersdonensis* sp. nov., of which seven occur on a single bedding plane, permit a range of intraspecific variation and effects of deformation to be taken into account in erecting a new species. A reconstruction of *E. kilmersdonensis* does not show the presence of long ophthalmic spines. It resembles the type species, *E. danae* (Meek and Worthen 1865), differing in the shape of the cardiac lobe and ornament of the opisthosoma. *Eophrynus jugatus* sp. nov. is the third recorded species of the genus *Eophrynus* (which is known only in Britain) differing in dorsal and ventral ornament from the type species, *Eophrynus prestvici* (Buckland 1837).

THE specimens of *Euproops kilmersdonensis* sp. nov. and *Eophrynus jugatus* sp. nov. described in this paper occur in laminated and current bedded grey, silty mudstones with comminuted plant debris associated with the No. 9 coal seam, which is the lowest seam of the Farrington Group in the Somerset coalfield. The Farrington Group is assigned to the *tenuis* Zone, of Westphalian D age.

The material described was found during a field excursion to the Bristol district and was discovered on the mine tip of Kilmersdon Colliery, near Radstock by Messrs. H. Bailey and R. Aldous, students in the Department of Geology, University of Sheffield, who kindly made the material available to the authors.

The genus *Euproops*, Upper Carboniferous to Permian, is widely known from rocks of Westphalian age, and has been recorded from North America and Europe. It is often found associated with fossil arachnids, and is generally regarded as being non-marine. Although specimens of *Euproops* are fairly common in comparison with numbers of other Xiphosura, the occurrence of seven exoskeletons of one species on a single slab (see Plate 112, fig. 1) is unusual and provides an opportunity for investigating intra-specific variation.

Eophrynus jugatus, is, as far as the authors are aware, only the third species of this genus to be described from Britain. Specimens of the first, *Eophrynus prestvici* (Buckland 1837) have been made available to the authors by Birmingham University and the British Museum. The second, *Eophrynus warei* (Dix and Pringle 1930) is referred to below.

TERMINOLOGY

The morphological terms for the *Merostomata* proposed by Størmer in Moore (1955) have been generally adopted. Some modifications to existing terms are used and other new terms are proposed to facilitate description.

¹denotes proposed new terms

²denotes modified terms

Prosoma Text-fig. 1A

Border—Synonymous with that defined by Harrington *et al.* in Moore (1959, p. O119).

¹Preophthalmic field—Area lying between the anterior border and cardiophthalmic region and limited laterally by the line running anteriorly (*exsag.*) from the eye to the border.

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- ¹Cardiac ridge—Median ridge running from the posterior margin of the cardiac lobe to the mid-point of the anterior branches of the ophthalmic ridges. It need not be continuous.
- ¹Cheek—Arca of the prosoma lying lateral to the cardiophthalmic region and preophthalmic field, excluding the border and genal spine.

Opisthosoma Text-fig. 1B

- ²Axis—Medial region of the opisthosomal dorsal exoskeleton, bordered by axial furrows. This proposal thus excludes the term cardiac lobe when referring to the opisthosoma.
- ¹Pleural rib—Dorsal transverse segment of the lateral portion of the opisthosoma bounded by the axial furrow and excluding the opisthosomal rim (see below).
- ²Pleural ridge—Ridge separating adjacent pleural ribs.
- ¹Opisthosomal rim—Flat flange surrounding the central raised portion on all but the anterior margin and crossed by ridges in direct continuation with the pleural ridges.
- ¹Opisthosomal spine—Laterally to posteriorly directed pointed extension of the opisthosomal rim with a ridge along the posterior margin.

Class MEROSTOMATA Dana, 1852
 Order XIPHOSURIDA Latreille, 1802
 Family EUPROOPIDAE Eller, 1938
 Genus EUPROOPS Meek, 1867

Type species. Euproops danae (Meek and Worthen 1865)

Euproops kilmersdonensis sp. nov.

Text-fig. 2; Plate 112, figs. 1–3; Plate 113, fig. 1

Diagnosis. *Euproops* with narrow, flat to roll-like border to prosoma; anterior part of cardiac lobe constricted; very short ophthalmic spines. Axis of opisthosoma with tubercle on first and third segment, short spine on terminal segment. Opisthosomal rim moderately narrow with long rim spines. Telson long.

Type material. Holotype. It. 61012 (Pl. 112, fig. 1; Pl. 113, fig. 1). Internal and external mould of nearly complete specimen. Internal mould figured. *Paratype.* It. 61013 (Pl. 112, figs. 1–3). Internal and external mould of nearly complete specimen. Internal mould figured. Other figured material. It. 61014, external mould; It. 61015, internal mould; It. 61016, external mould; It. 61017, external mould; It. 61018, internal mould. Counterpart of material figured in Plate 112, fig. 1 is retained in the reference collections of the Department of Geology, University of Sheffield.

The specimens figured are in the collections of the British Museum (Natural History) and their numbers are prefixed It.

Horizon and locality. No. 9 seam, Farrington Group (*tennis* Zone, Westphalian D). Upper Carboniferous (Moore and Trueman 1937, p. 228). Mine tip at Kilmersdon Colliery (Grid reference ST 681536) near Radstock, Somerset.

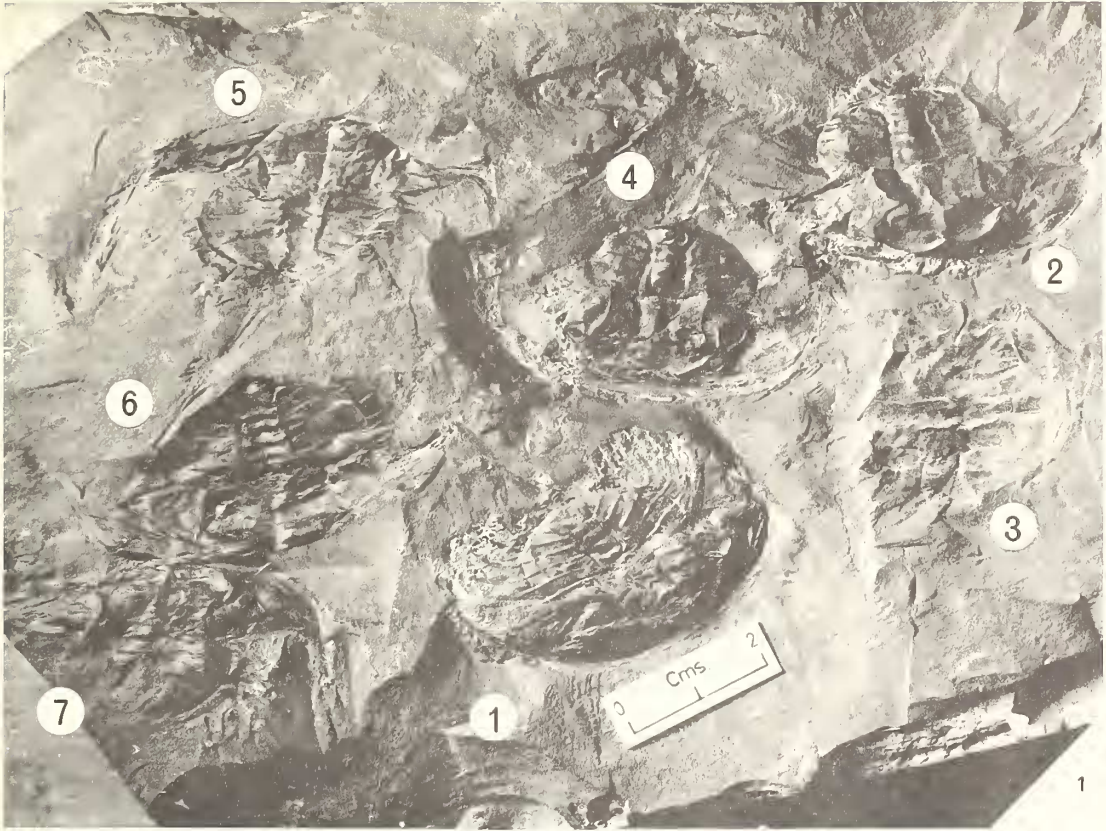
Derivation of name. After the colliery at Kilmersdon where the specimens were found.

Measurements. Dimensions in mm. (c) denotes estimated.

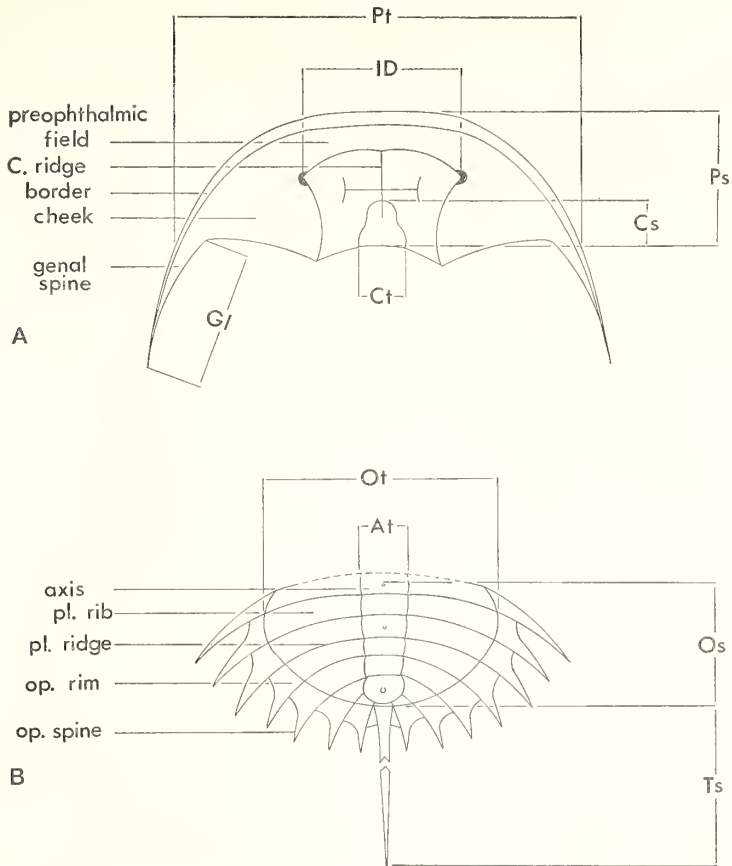
EXPLANATION OF PLATE 112

Fig. 1. Slab with seven specimens of *Euproops kilmersdonensis* sp. nov. Specimen 1 Holotype (It. 61012) Internal mould; 2 Paratype (It. 61013) Internal mould; 3–7 Not type material. 3 (It. 61014) External mould; 4 (It. 61015) Internal mould; 5 (It. 61016) External mould; 6 (It. 61017) External mould; 7 (It. 61018) Internal mould.

Figs. 2, 3. *Euproops kilmersdonensis* sp. nov. Paratype (It. 61013). Internal mould. 2, dorsal view of detail of cardiophthalmic region, $\times 4$. 3, dorsal view of detail of left side of opisthosoma, $\times 3$. Specimens whitened with ammonium chloride before photographing.



AMBROSE and ROMANO, *Euproops*



TEXT-FIG. 1. Diagram showing measurements taken and new or modified terms for *E. kilmersdonensis* sp. nov.

Key to Symbols:

- Ps Prosomal length measured in the sagittal line from the posterior margin of the cardiac lobe to the anterior margin.
- Pt Prosomal width measured in a transverse direction along the posterior margin of the cardiac lobe.
- Cs Length of cardiac lobe measured in sagittal line.
- Ct Width of cardiac lobe measured in a transverse direction along the posterior margin.
- ID Interocular distance measured in a transverse direction between the eyes.
- G1 Length of genal spine measured along the length of the spine.
- Os Opisthosomal length measured in the sagittal line from the posterior margin of the cardiac lobe to the posterior margin of the opisthosoma.
- Ot Opisthosomal width measured in a transverse direction through the greatest width.
- At Axial width measured in a transverse direction at the anterior end.
- Ts Length of telson measured along its length.

Abbreviations:

C. ridge	Cardiac ridge	pl. rib	Pleural rib
pl. ridge	Pleural ridge	op. rim	Opisthosomal rim
op. spine	Opisthosomal spine		

TABLE 1. Some measurements taken on *E. kilmersdonensis* sp. nov. For explanation of symbols see key to text-fig. 1.

Symbol	Specimen									
	1	2	3	4	5	6	7	8	9	10
Ps	14	14.5	17	13	12.5	12(e)	10.5	—	10.5	21
Pt	36	48	32	41.5	48	53(e)	48(e)	—	34(e)	36.5
Cs	5.5	4.5	6	5.5	5(e)	5.5	6	—	4.5	7(e)
Ct	5.5	6.5	4.5	5(e)	—	—	5	5(e)	4	—
ID	15(e)	18	13(e)	17.5(e)	19	22	18.5	—	12(e)	14
Gl	+12	—	15	—	+11	—	+11	—	—	+10
Os	12	10.5	14	10.5	11.5	12.5	—	18	11.5(e)	—
Ot	20	24	27(e)	25(e)	25	27	22(e)	16	17(e)	—
At	5.5	6.5	4	6	6.5	7	—	3.5(e)	—	—
Ts	+17	+15	—	+10	39	—	—	—	—	—

TABLE 2. Some ratios of measurements taken on *E. kilmersdonensis* sp. nov.

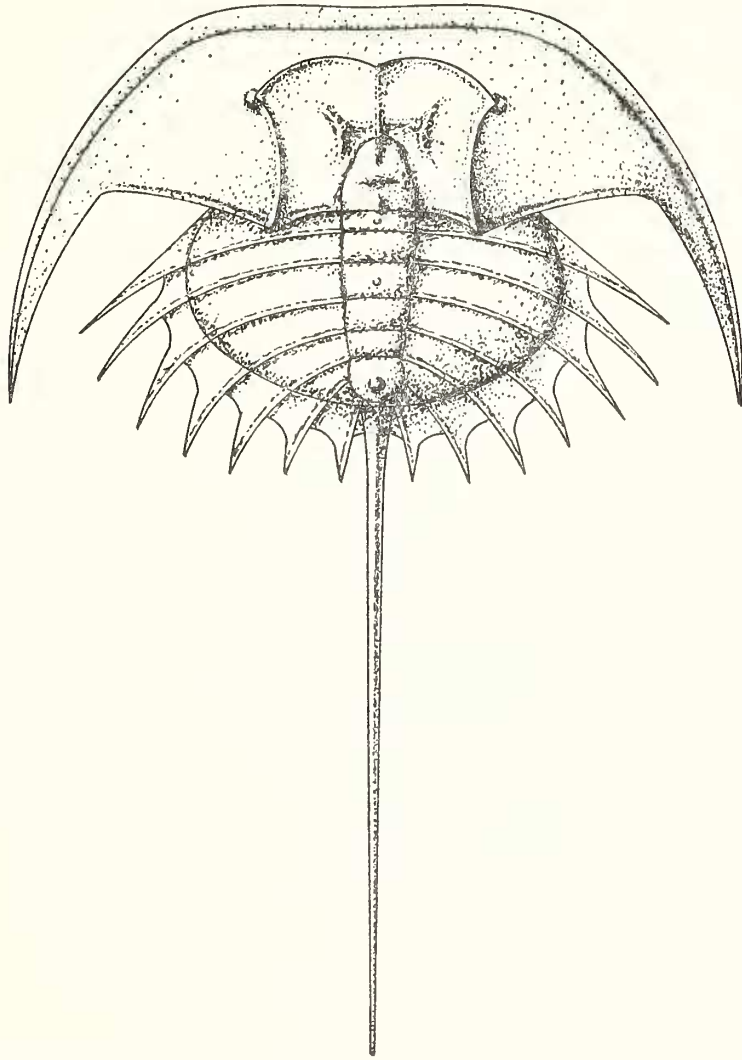
Specimen	Ratio			
	Ps:Pt	Os:Ot	Ps:Os	ID:Pt
1	1:2.6	1:1.7	1.2:1	1:2.4
2	1:3.3	1:2.3	1.4:1	1:2.7
3	1:1.8	1:1.9	1.2:1	1:2.5
4	1:3.2	1:2.4	1.2:1	1:2.4
5	1:4.6	1:2.2	1.1:1	1:2.5
6	1:4.4	1:2.2	1.0:1	1:2.4
7	1:4.6	—	—	1:2.6
8	—	1:0.9	—	—
9	1:3.2	1:1.5	0.9:1	1:2.8
10	1:1.7	—	—	1:2.6

Specimens in Tables 1 and 2 numbered 1–7 refer to those in Plate 112, fig. 1; specimens 8–10 from the same mudstone fragment are not figured and are in the reference collections of the Department of Geology, University of Sheffield.

Deformation of the sediment may be approximated to a compression of the mudstones parallel to the transverse axis of specimen 3 (Plate 112, fig. 1) as length to width ratios show greatest variation in specimens 3 and 6 which lie parallel and at right angles respectively to the direction of elongation. Original right angles are distorted in specimens (1 and 2) lying oblique to this direction. The absolute measurements (Table 1) and ratios of measurements taken either along the length or width of the specimens (Table 2) suggest a range of variation consistent with the assemblage being of adults of the same species. The number of specimens available for study does not warrant statistical analysis.

Description. The prosoma is approximately semi-circular in outline with a straight margin anterior to the precardiophthalmic field. The prosomal border is narrow, widest (*sag.*) anteriorly and flat to gently roll-like in cross section. The narrow doublure is widest anteriorly and continues with the border along the genal spine. The cardiophthalmic region is gently convex dorsally; the narrow (*sag.*) precardiophthalmic field slopes steeply down to anterior border. The cheeks are fairly wide (*trans.*) and slope gently outwards. There is a narrow (*exsag.*) border and shallow furrow along the posterior margin of the prosoma.

The cardiophthalmic region is delimited by prominent ophthalmic ridges. Anterior to the eyes the ophthalmic ridges form a double arch; posterior to the eyes the ridges are concave outwards and continue backwards to protrude just beyond the posterior



TEXT-FIG. 2. Reconstruction of *Euproops kilmersdonensis* sp. nov. based on holotype and paratype. Dorsal view: $\times 2$ (length of telson taken from specimen It. 61016, see Plate 112, fig. 1).

margin as short spines (less than 1 mm in length). The distance between the ophthalmic spines is slightly less than the interocular distance. The cardiophthalmic region shows considerable wrinkling of the exoskeleton in all specimens but there is a fairly continuous transverse ridge in most which crosses the area anterior to the cardiac lobe and

just posterior to the eyes, and dies out laterally before reaching the ophthalmic ridges. In a few specimens traces of other ridges within the cardiophthalmic region make an 'H' shaped pattern with the transverse ridge described above as the connecting ridge. The cardiac lobe is sub-triangular in outline with a nearly straight anterior margin and approximately as wide as long. The sides of the cardiac lobe converge quite strongly at about midlength and anterior to this the sides are more parallel sided. The cardiac lobe is bounded by a shallow furrow except anteriorly where the cardiac ridge crosses the furrow and continues to the anterior branch of the ophthalmic ridge. The cardiac ridge terminates at a distance of approximately one-third the length of the cardiac lobe from the anterior end and is represented by a small tubercle at the posterior end of the lobe. At about the midlength of the lobe a broad (*sag.*) shallow transverse furrow may occasionally be seen (Pl. 112, fig. 2). The eyes are rarely preserved, and occur as small convex tubercles (0.5 mm across). Long, slightly curved genal spines are directed posteriorly or posterolaterally reaching to the posterior margin of the opisthosoma. The prosomal border continues along the genal spines. The central raised portion of the opisthosoma is oval in outline with maximum width at just under one-third the distance from the anterior margin. The axis is widest anteriorly where it is about the same width as the cardiac lobe along the posterior margin, narrowing slightly posteriorly to the expanded terminal segment. The axis is gently convex (*trans.*) and bordered by shallow furrows. Five axial rings of about the same length (*sag.*) are developed and separated by shallow furrows. The terminal segment is globular in shape, standing above the axial rings and not quite reaching the opisthosomal rim. The first and third axial rings bear a small median tubercle; the terminal segment has a short centrally placed spine. The pleurae are fairly flat except near margin where they are steeply downturned. In some specimens (Pl. 113, fig. 1) a distinct geniculation on the pleurae exists along a line in continuation with the ophthalmic ridges (see Discussion). Up to seven pleural ribs are present, becoming narrower (*exsag.*) and directed more backwards towards the posterior end. The opisthosomal rim is moderately narrow with seven long, slender, gently curved opisthosomal spines. The more posterior spines are shorter and directed more backwards. Pleural ridges separating the pleural ribs pass along the posterior edge of the spines (Pl. 112, fig. 3).

The telson is long, slightly carinate, and reaches to nearly twice the length of the body. The telson is ornamented with numerous fine, discontinuous, wavy ridges running oblique to the length.

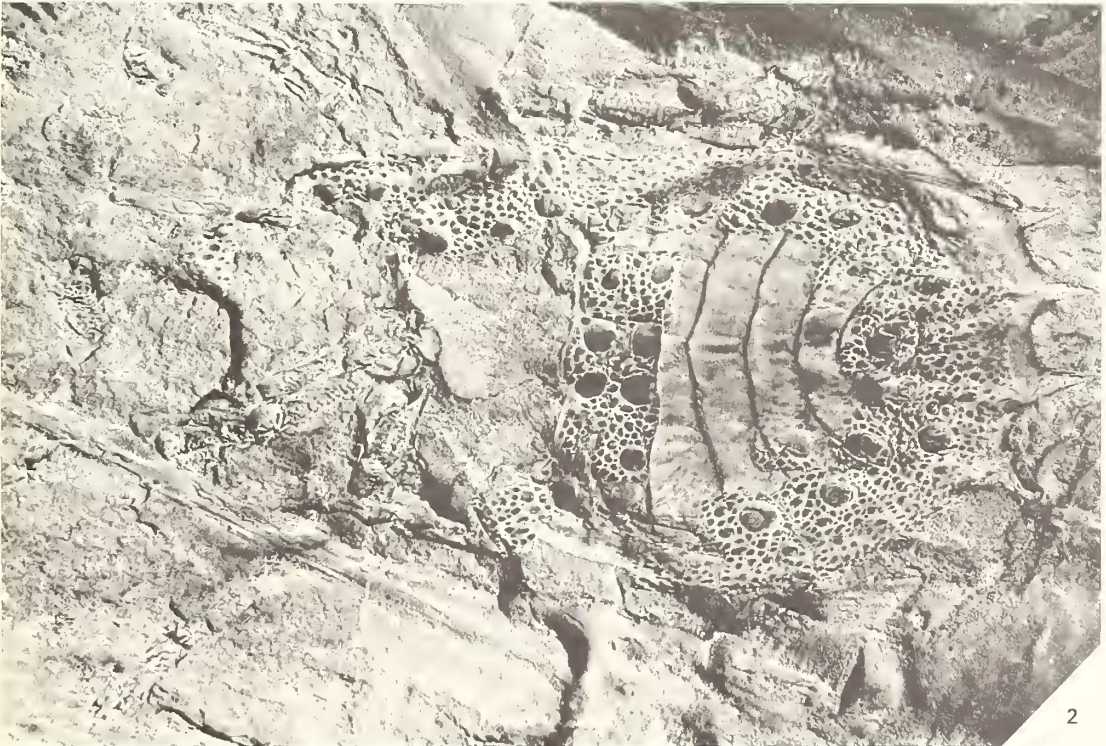
Discussion. *Euproops kilmersdonensis* sp. nov. differs from *E. rotundatus* (Prestwich) in several important characters. The cardiac ridge of *E. rotundatus* continues along the length of the cardiac lobe to the posterior margin whereas in *E. kilmersdonensis* the ridge is interrupted by a transverse furrow at about the midlength of the lobe. The major differences however are on the opisthosoma where in *E. rotundatus* the opisthosomal rim

EXPLANATION OF PLATE 113

- Fig. 1. *Euproops kilmersdonensis* sp. nov. Holotype (It. 61012). Internal mould of nearly complete individual. Dorsal view, $\times 2.4$. Specimen whitened with ammonium chloride before photographing.
 Fig. 2. *Eoplrynus jugatus* sp. nov. Holotype (It. 61019). Internal surface of dorsal part of abdomen with part of ventral exoskeleton attached. Ventral view, $\times 4$. Specimen whitened with ammonium chloride before photographing.



1



2

AMBROSE and ROMANO, *Euproops*, *Eophrynus*

